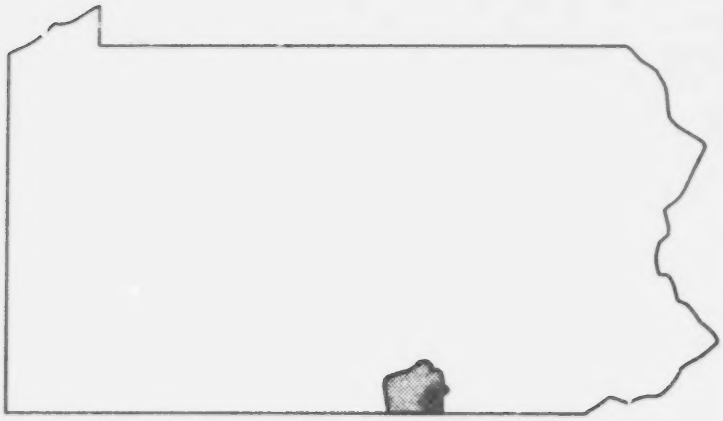
FLOOD INSURANCE STUDY

TOWNSHIP OF CONEWAGO, PENNSYLVANIA
ADAMS COUNTY



MARCH 4, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 421248

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWNSHIP OF CONEWAGO, ADAMS COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Conewago, Adams County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 8. This work was completed in July 1986.

1.3 Coordination

On November 13, 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the township, and the USGS (the study contractor) to determine the streams to be studied by detailed methods. On April 15, 1987, a final CCO meeting was held with representatives of FEMA, the township, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Conewago, Adams County, Pennsylvania. The Borough of McSherrystown, which is completely surrounded by the township, is not included in this study. The area of study is shown on the Vicinity Map (Figure 1).

South Branch Conewago Creek was studied by detailed methods from the downstream corporate limits to a point approximately 800 feet downstream of State Route 116. Plum Creek was studied by detailed methods from a point approximately 0.57 mile downstream of the downstream corporate limits of McSherrystown to the upstream corporate limits of McSherrystown. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through July 1991.

The remaining portions of South Branch Conewago Creek and Plum Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Conewago.

2.2 Community Description

The Township of Conewago is located in the southeastern part of Adams County in south-central Pennsylvania, approximately 10 miles southeast of Gettysburg. It is bordered by the Townships of Oxford and Berwick to the north, the Township of Penn and the Borough of Hanover to the east, the Township of Union to the south and west, and the Township of Mt. Pleasant to the west.

2.3 Principal Flood Problems

Major floods cause localized inundation of structures along South Branch Conewago Creek and Plum Creek.

2.4 Flood Protection Measures

There are no flood-control structures on streams that flow through the Township of Conewago.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood

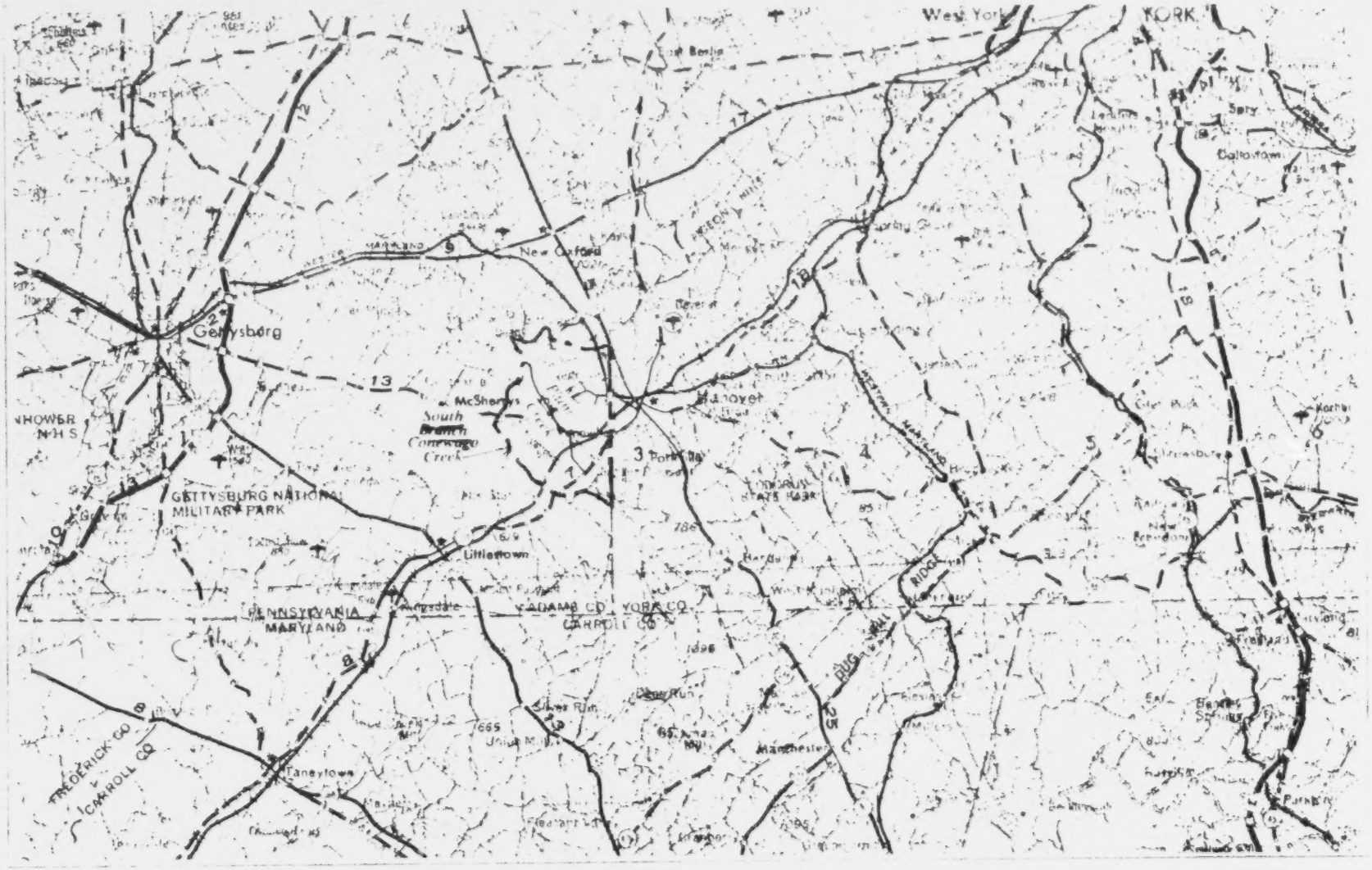


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The flood-frequency discharge value for South Branch Conewago Creek was obtained from the Flood Insurance Study for the Township of Mt. Pleasant (Reference 1).

The flood frequency discharge value for Plum Creek was determined utilizing regional regression equations developed in USGS Water Resources Investigations 82-21 (Reference 2). The Pennsylvania State University PSU-IV method confirmed the determination (Reference 3). This technique was developed for specific use in estimating peak flood flows for ungaged sites on small streams in Pennsylvania.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
SOUTH BRANCH CONEWAGO CREEK		
At Legislative Route 01005	32.4	10,000
PLUM CREEK		
Approximately 0.5 mile downstream of downstream corporate limits of Borough of McSherrystown	7.65	2,000

Cross sections for the streams studied by detailed methods were field surveyed and located at close intervals above and below bridges and culverts to compute the significant backwater effects of these structures. All bridges and culverts in the community were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

The hydraulic analysis and the 100-year water-surface elevations for South Branch Conewago Creek were obtained from the Flood Insurance Study for the Township of Mt. Pleasant (Reference 1).

The 100-year water-surface elevations for Plum Creek were computed by modeling channel and bridge hydraulics with the WSPRO step-backwater computer program (References 4 and 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of engineering judgment and field inspection of the floodplain areas. The channel "n" values ranged from 0.038 to 0.055, and the overbank "n" values ranged from 0.045 to 0.140.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the streams studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 6).

For the streams studied by approximate methods, the floodplain boundaries were delineated using the Flood Hazard Boundary Map for the Township of Conewago (Reference 7).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway

fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this study is presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodway presented in this study was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodway is shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway widths for South Branch Conewago Creek extend beyond the corporate limits.

No floodways were calculated as part of this study; floodway information for South Branch Conewago Creek was taken from the Flood Insurance Study for the Township of Mt. Pleasant (Reference 1).

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Branch Conewago Creek								
A	460	700	5,280	2.0	509.1	509.1	510.0	0.9
B	1,385	920	7,602	1.4	509.4	509.4	510.4	1.0
C	2,135	980	7,616	1.4	509.6	509.6	510.6	1.0
D	3,085	1,330	9,627	1.1	509.8	509.8	510.7	0.9
E	3,840	1,110	6,002	1.7	510.3	510.3	511.1	0.8
F	5,130	800	3,324	3.0	510.8	510.8	511.7	0.9
G	5,455	720	2,693	3.7	511.9	511.9	512.5	0.6
H	6,405	650	2,164	4.6	513.9	513.9	514.4	0.5
I	7,290	700	3,577	2.8	516.5	516.5	517.5	1.0
J	8,075	680	3,888	2.6	517.2	517.2	518.1	0.9
K	8,430	630	4,066	2.5	518.6	518.6	519.4	0.8
L	9,360	570	3,990	2.5	519.2	519.2	520.2	1.0
M	10,645	650	4,190	2.4	520.0	520.0	520.9	0.9
N	11,715	710	3,494	2.9	521.1	521.1	522.0	0.9
O	12,570	700	4,551	2.2	522.5	522.5	523.4	0.9
P	14,170	1,000	4,542	2.2	523.7	523.7	524.7	1.0

[1]Feet above corporate limits

[2]This width extends beyond corporate limits

TABLE 2

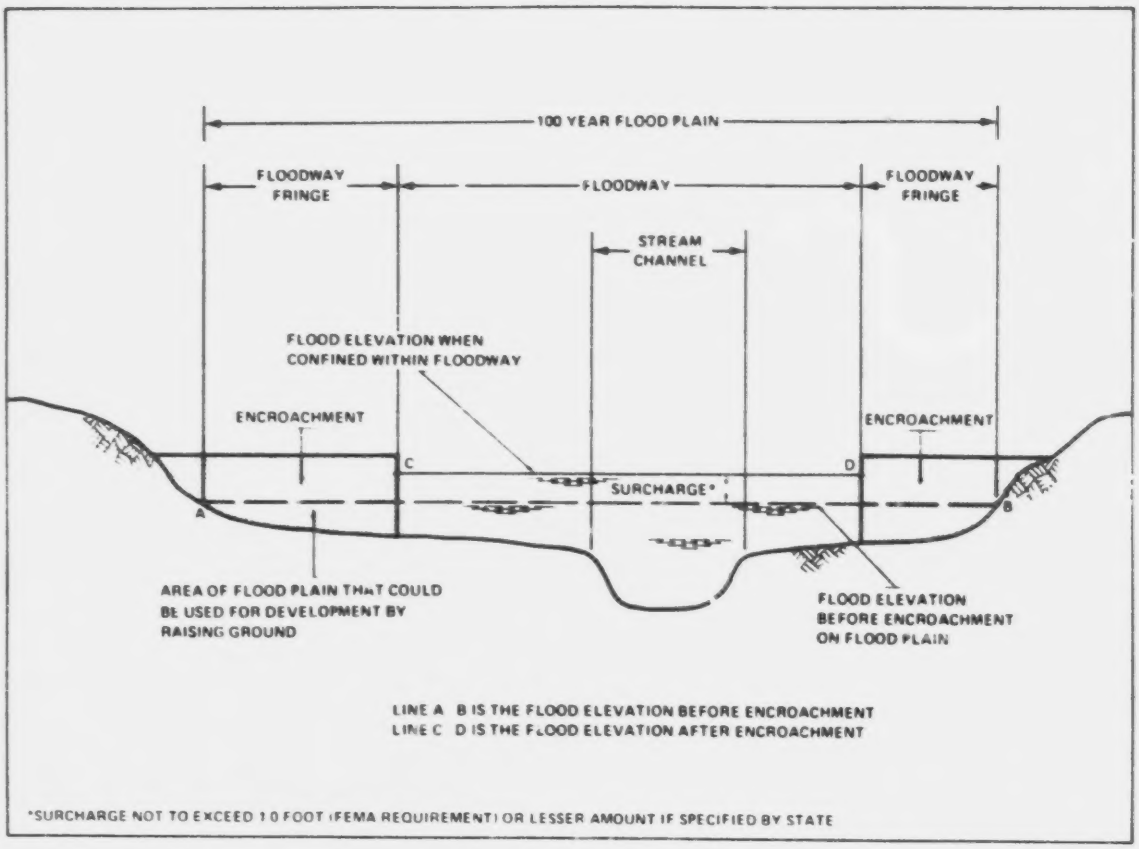
FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Conewago, PA

(Adams Co.)

FLOODWAY DATA

SOUTH BRANCH CONEWAGO CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies for the following communities have been prepared: the Townships of Mt. Pleasant, Oxford, Berwick, Union, and Penn; and the Borough of Hanover (References 1, 8, 9, 10, 11, and 12). This study does not agree with the approximate analyses of Slagle Run and Indian Run in the Township of Penn and the approximate analysis of an unnamed tributary to Slagle Run in the Township of Berwick; those streams were not analyzed in this study. All other results of this study are in exact agreement with results of those studies.

A Flood Insurance Study for the Borough of McSherrystown is currently being prepared (Reference 13). The results of that study will be in exact agreement with the results of this study.

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the Township of Conewago (Reference 7).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Mt. Pleasant, Adams County, Pennsylvania, Washington, D. C., December 1, 1981.

2. U. S. Department of the Interior, Geological Survey, Water Resources Investigations 82-21, Evaluation of the Streamflow-Data Program in Pennsylvania by H. N. Flippo, Jr., Harrisonburg, Pennsylvania, 1982.

3. The Pennsylvania State University, Institute for Research on Land & Water Resources, Report FHWA/PA 81-013, Procedure PSU-IV for Estimating Design Peaks on Ungaged Pennsylvania Watersheds by G. Aron and D. F. Kibler, University Park, Pennsylvania, 1981.

4. U. S. Department of Transportation, Federal Highway Administration, Report FHWA/RD-86/108, Bridge Waterways Analysis Model/Research Report by J. O. Shearman, W. H. Kirby, V. R. Schneider, and H. N. Flippo, Jr., Washington, D. C., 1986.

5. National Technical Information Service, Bridge Waterways Analysis Model/User's Instructions by J. O. Shearman, W. H. Kirby, and V. R. Schneider, Springfield, Virginia, 1985.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Hanover, Pennsylvania, 1954, Photorevised 1973; McSherrystown, Pennsylvania, 1944, Photorevised 1973.

7. U. S. Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Conewago, Adams County, Pennsylvania, November 22, 1974.

8. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Oxford, Adams County, Pennsylvania, Washington, D. C., December 1, 1981.

9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Berwick, Adams County, Pennsylvania, Washington, D. C., November 4, 1981.

10. Federal Emergency Management Agency, Flood Insurance Study, Township of Union, Adams County, Pennsylvania, Washington, D. C., December 4, 1985.

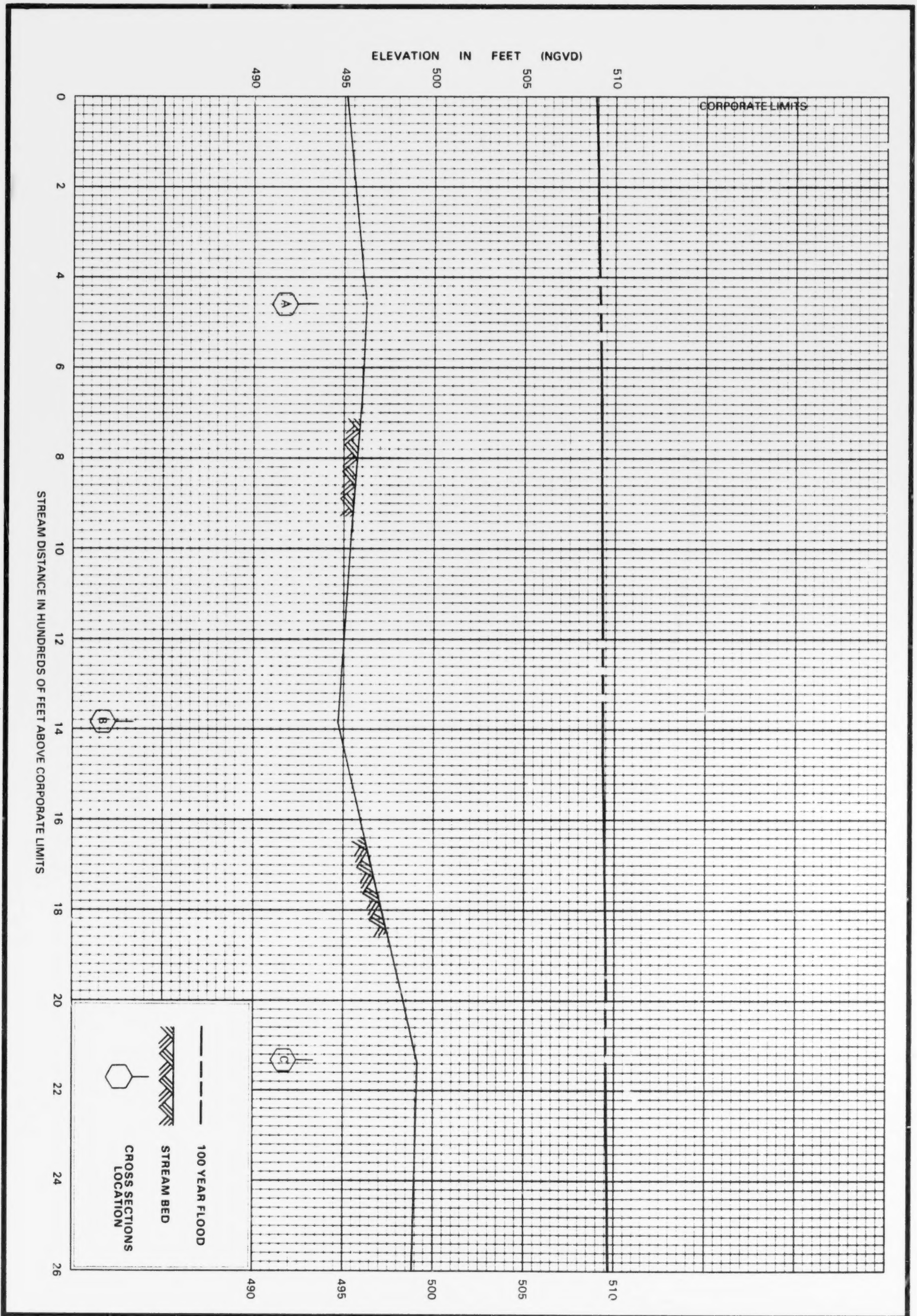
11. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Township of Penn, York County, Pennsylvania, Washington, D. C., October 15, 1981.

12. Federal Emergency Management Agency, Flood Insurance Study, Borough of Hanover, York County, Pennsylvania, Washington, D. C., January 6, 1982.

13. Federal Emergency Management Agency, Flood Insurance Study, Borough of McSherrystown, Adams County, Pennsylvania (Unpublished).

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	527.27	PDH disk set in top of southeast wing wall of State Route 116 bridge over South Branch Conewago Creek.
RM 2	521.06	PDH disk set in northeast corner of Legislative Route 01005 bridge over South Branch Conewago Creek.
RM 3	510.04	Chiseled square cut in southeast corner of wing wall of covered bridge on Legislative Route 01060 over South Branch Conewago Creek.
RM 4	507.43	PDH disk set in top of southeast wing wall of Legislative Route A-5510 bridge over Quarry Channel.
RM 5	528.65	Chiseled square cut on top of southwest wing wall beside PDH disk, on State Route 116 bridge over Plum Creek.



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FEDERAL EMERGENCY MANAGEMENT AGENCY

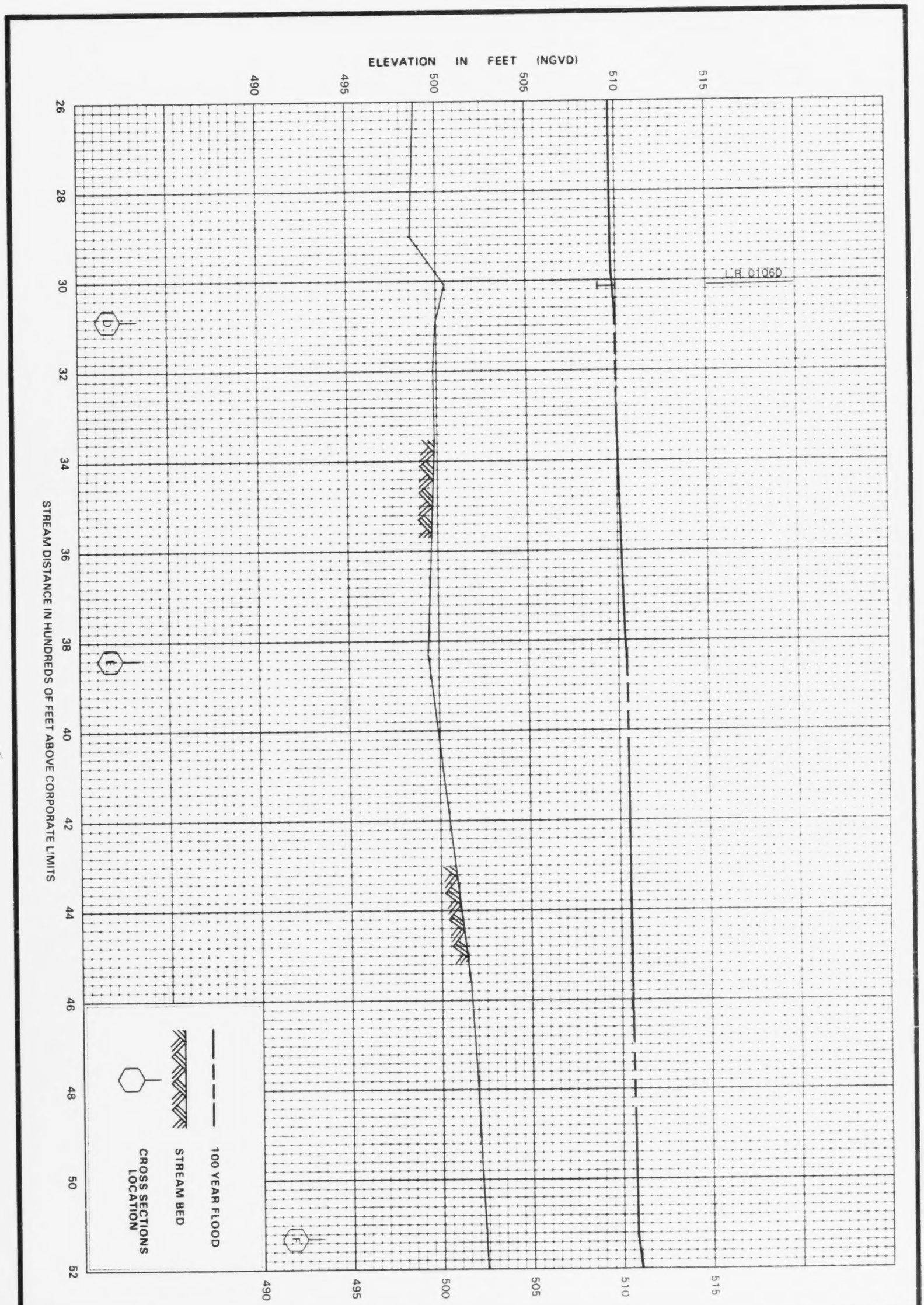
TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

FLOOD PROFILES

SOUTH BRANCH CONEWAGO CREEK

01P



FEDERAL EMERGENCY MANAGEMENT AGENCY

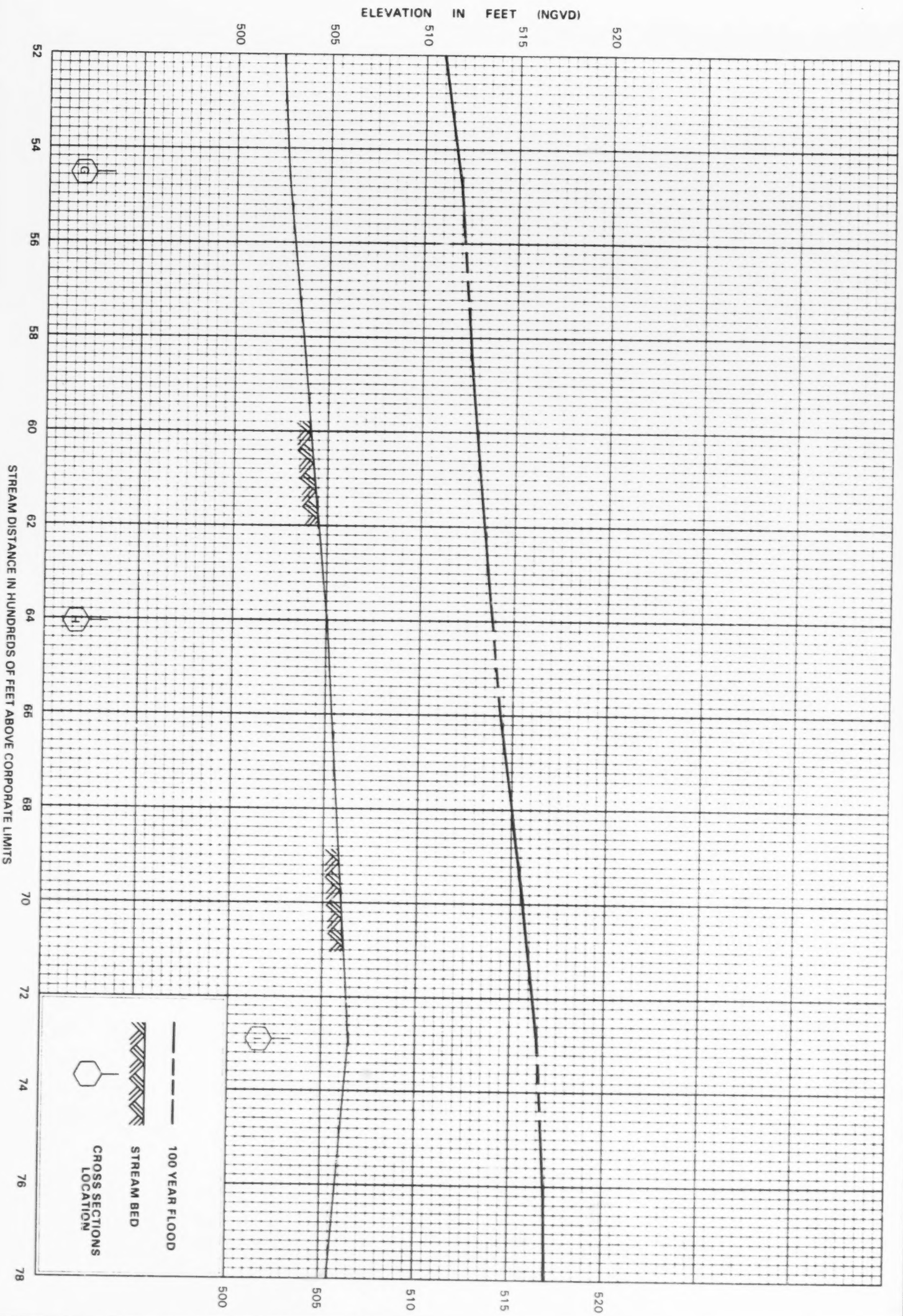
TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

02P

FLOOD PROFILES

SOUTH BRANCH CONEWAGO CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

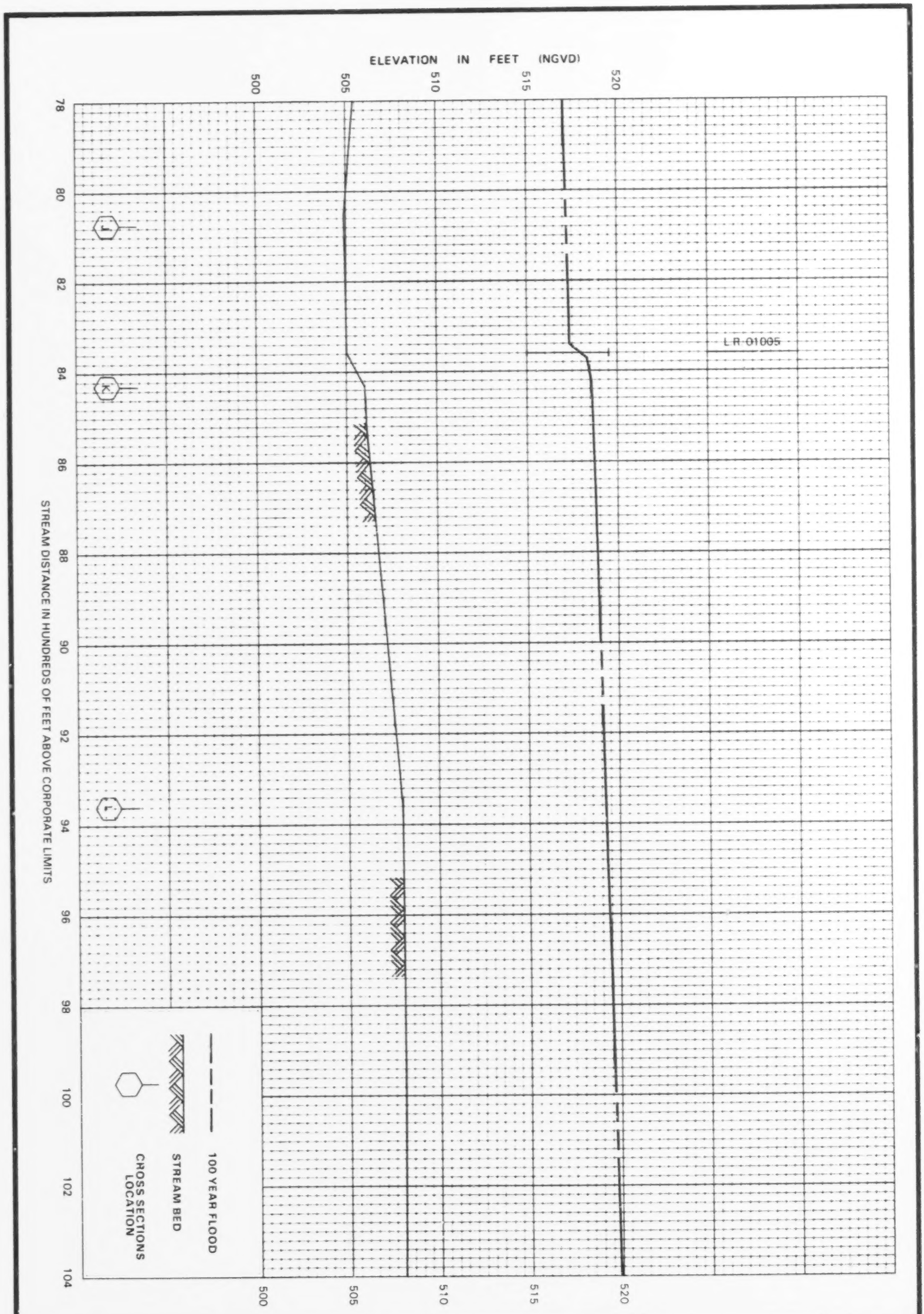
TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

FLOOD PROFILES

SOUTH BRANCH CONEWAGO CREEK

03P



FEDERAL EMERGENCY MANAGEMENT AGENCY

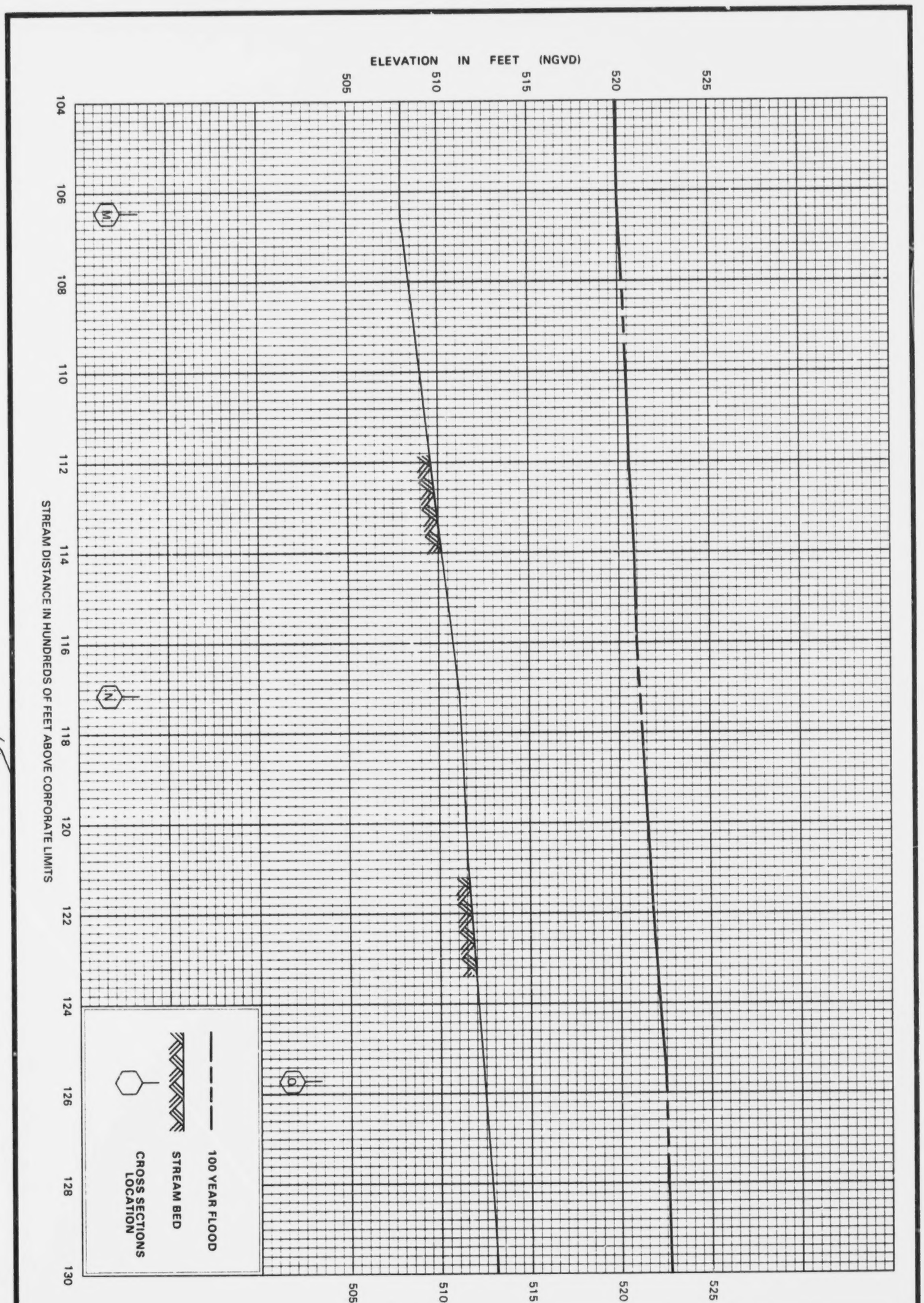
TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

04P

FLOOD PROFILES

SOUTH BRANCH CONEWAGO CREEK



FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

FLOOD PROFILES

SOUTH BRANCH CONEWAGO CREEK

05P

FLOOD PROFILES

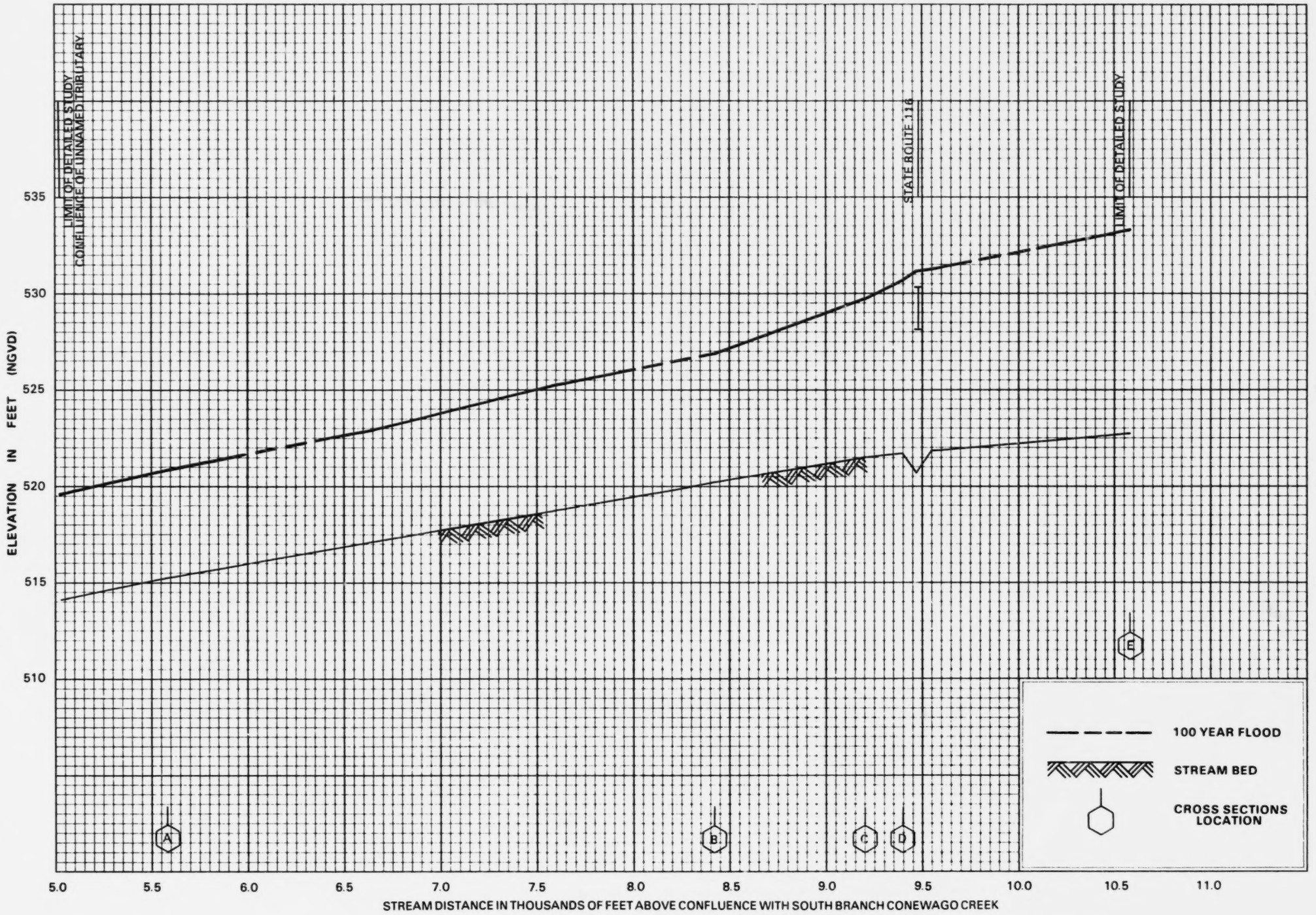
SOUTH BRANCH CONEWAGO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

06P



FLOOD PROFILES

PLUM CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF CONEWAGO, PA

(ADAMS CO.)

07P